Abstract

The application of the Hazard Analysis and Critical Control Point (HACCP) system is rapidly progressing, in particular in large and medium scale food industries. The term is becoming well known in food control and public health circles and is one which evokes food safety. However, concomitant with the headway of the HACCP system in food safety management, the incidence of foodborne diseases is increasing worldwide. Does the increase in foodborne diseases represent a paradox or failure of the HACCP system? The HACCP system is not a panacea for all food safety problems. It is a tool that guides food safety assurance personnel in the identification of pertinent hazards and control measures, ensuring that those which are critical for food safety are applied correctly. In this way, it enhances the safety of the food supply. While the application of the HACCP system can improve food safety in all situations, its strength and success in preventing foodborne illnesses depend on it being applied correctly and in combination with other food safety management systems, including the provision of a sanitary infrastructure and the application of principles of good hygienic practice. The paper presents the reasons for the increase in foodborne diseases, the role that the HACCP system plays in preventing foodborne diseases, the determinants of its success and failure, and the contribution which can reasonably be expected from the implementation of the HACCP system to public health. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: HACCP; Food safety; Foodborne disease; Good hygienic practice; Food control

1. Introduction

In 1991, a cholera epidemic swept over the Latin American continent, resulting in over 250,000 cases of cholera and about 2700 deaths within one year. A few years later, a newly recognized type of disease, the EHEC infection, seized Japan by surprise and in one single outbreak affected more than 9500 people, mainly school children. 11 people died.

These two major epidemics/outbreaks of foodborne diseases, including many others, large and small, which have occurred in recent years around the world, have alerted public health authorities to the looming problem of foodborne diseases. They are a warning that any country, regardless of its stage of development, can be affected by foodborne diseases and that these can be very deadly, in particular for vulnerable groups such as infants and children, the elderly, pregnant women and immunocompromised persons. They also remind the public health authorities that with the industrialization and globalization of the food supply and with the modern lifestyle, foodborne diseases can strike a population in masses and disrupt the health system of unprepared countries.

Through population and other epidemiological surveys, the public health authorities in a number of countries have furthermore come to realize that the cases of foodborne diseases reported to the authorities constitute the tip of the iceberg only and that an even greater number of victims suffer in silence without these cases ever being reported. In the industrialized countries, the incidence of foodborne diseases is estimated to be under-reported by a factor of 100–350, depending on the nature of the disease, perception of the risk of the disease and the health system.

Today, it is estimated that there are approximately 4000 million cases of diarrhoeal disease annually in the world, mainly – but not exclusively – in the developing countries. Some 1500 million episodes of diarrhoea...
occur in children under the age of five. In the developing countries, some children are affected by up to 10–12 episodes per year. Over 3 million children succumb as a result. The association of diarrhoeal diseases and malnutrition causes an even greater number of deaths. Food (including drinking water) is the major vehicle for these diseases and is the cause of up to 70% of the cases. In industrialized countries, up to 10% of the population are estimated to suffer annually from a foodborne disease.

The problem of foodborne diseases is beyond imagination. The cruel fact is that in some parts of the world their occurrence is so frequent that they have become a fact of everyday life. In a great number of countries, either due to lack of resources or awareness, the public health authorities undertake very few measures to investigate or prevent foodborne diseases lest they become an obstacle to food export or tourism.

Although the problem of foodborne diseases is not a new public health problem, the problem has taken a new dimension at the end of the 20th century, both in terms of magnitude and in terms of health consequence. As will be discussed later, many factors related to the food supply system, health and demographic situation, lifestyle, the health system and infrastructure, and the environmental conditions of the country influence their prevalence, increase and health consequences.

Concomitant with the increase in foodborne diseases, the Hazard Analysis and Critical Control Point (HACCP) system, as a new method of food safety assurance, made its appearance in the food safety management system of food industries, and as a regulatory tool in the food control systems in several countries, in particular in the industrialized countries. The attention that the HACCP system has received, both in the private and public sectors, has been in recognition of the increasing importance of food safety to public health and economic development (including promotion of food trade), the increasing incidence of foodborne diseases, and the additional advantages that the system offers over the traditional prescriptive approach.

For some years, the public health and food control authorities worldwide have promoted the concept of HACCP. Some countries have taken steps to include it in their legislation as a mandatory requirement. Nevertheless, the incidence of foodborne diseases continues to rise. Therefore, a question that one may ask is whether the increase in foodborne diseases and the advances in the implementation of HACCP constitute a paradox or demonstrate a failure in the system? This is certainly not the case. The high incidence and continuous increase experienced in some countries is neither a paradox nor a failure in the HACCP system. The paradox results from a misunderstanding of what HACCP is and what it is not, what it can do to prevent foodborne diseases and the factors influencing these. This paper reviews the factors influencing the increase in foodborne diseases, the potential of the HACCP system in preventing foodborne illnesses and the determinants of its success and failure.

2. Factors influencing the incidence of foodborne diseases

Foodborne diseases are age-old diseases which have occurred since the beginning of human history and will continue to take place. The dramatic increase in foodborne diseases experienced in recent years in some countries is a consequence of the influence of different factors, often inter-related and complex, the control of some of which lies beyond the control of the public health authorities. These factors include changes in the:

(a) Food supply system:
- Mass production and distribution, leading to opportunities for contamination and also larger foodborne disease outbreaks.
- Intensive agriculture and animal husbandry practices, leading to increased contamination of raw foodstuffs and increased use of pesticides and veterinary drugs.
- International trade and import of potentially contaminated food.
- A longer food chain as a result of urbanization, leading to greater opportunities for contamination, survival and growth.
- Booming food service establishments where food handlers do not necessarily have any training in food hygiene.

(b) Health and demographic situation, including
- Population growth.
- Increase in number of vulnerable groups, e.g. the elderly, immunocompromised individuals and malnourished persons.
- Increase in number of displaced persons and refugees, often in a condition of poor health and nutrition as a result of man-made or natural disasters (e.g. wars, floods, earthquakes, etc.).
- Rapid urbanization, in some areas without the necessary water supply and sanitation infrastructure.

(c) Social situation, behaviour and lifestyles resulting in
- Increased consumption of food outside the home with a subsequent increase in the number of food service establishments.
- Increased travel and exposure to unsafe food.
- Changes in food preparation habits as a consequence of changes in family structure.
- Poverty and lack of education.
- Changed social and cultural behaviour leading to predilection for certain types of hazardous food.
- Lack of time and striving for increased economic profits.
Lack of training and education of food handlers and consumers in food safety.

(d) Health system and infrastructure resulting in

- A decrease in resources with a simultaneous increase in the number of food businesses which require supervision, guidance and control.
- Continued lack of water supply and sanitation as well as of fuel for cooking in some parts of the world, inadequate education and training of health workers in food safety, with subsequent incapacity of the country to implement adequate and relevant health educational activities in the area of food safety.
- Weaknesses in the investigation and surveillance of foodborne diseases and monitoring of contaminants leading to a consequential chain of problems, such as lack of information about food safety problems and priorities, incapacity to evaluate the impact of food safety interventions, and lack of awareness of public health authorities of the magnitude and the consequences of foodborne diseases.
- Availability and access to health technologies, including food technologies and telecommunication, etc.

(e) Environmental conditions, such as

- Pollution of the environment.
- Climatic conditions and changes.
- Changes in ecological systems resulting in diminishing fresh water and adequate food supplies.

Therefore, the mere fact that foodborne diseases continue to occur or increase in some parts of the world is not necessarily a sign of failure in the HACCP system, nor does it reflect a paradox. It may however be argued that without a system such as the HACCP system, more foodborne diseases would have occurred, leaving the public health authorities in a much weaker position to combat foodborne illnesses.

3. Potential of HACCP to prevent foodborne illnesses

Without a doubt, the HACCP system provides food industries and public health authorities with a powerful tool to combat foodborne illnesses. However, with regard to the fact that foodborne illnesses continue to increase despite progress in the implementation of the HACCP system, the following observations may furthermore be made:

Firstly, it should be realized that presently the greatest potential for the HACCP system in the prevention of foodborne diseases lies in the prevention of large outbreaks. However, the number of outbreak-related cases constitutes only a small fraction of the total number of reported cases. The greatest majority of foodborne diseases occur as sporadic cases. As Fig. 1 shows for salmonellosis and campylobacteriosis, which are the leading foodborne diseases in the industrialized regions of the world, the number of outbreak-related cases is very small compared to the total number of cases (Borgdorff & Motarjemi, 1997).

Fig. 1. Annual incidence of a) campylobacteriosis and b) salmonellosis in The Netherlands according to different systems of surveillance (adapted from P. Sockett, Ph.D thesis)
Secondly, the concept of the HACCP system is still relatively new in public health and food control. Although the concept of HACCP was developed some 30 years ago, it is only during the last few years that the HACCP system has been on the agenda of food control and public health authorities and has been internationally recognized as a reference method for food safety assurance. It will take many years before the world will see HACCP routinely implemented in all food industries, particularly in small-size industries, and having any tangible effect.

Thirdly, the system is not widely applied where it is mostly needed. Today, the HACCP system is implemented with some degree of success in the major large and medium-size food industries, and evidence of improved safety for foods produced under the HACCP system is beginning to surface (Lambiri, Mavridou & Papadakis, 1995; Hernandez Torres, 1998). However, where food safety problems are particularly important and better control of the risk is needed, i.e. in small food businesses, the HACCP system has still not made headway.

Worldwide, analysis of foodborne disease outbreaks show that the greatest majority of foodborne disease outbreaks result from malpractice during food preparation in small food businesses, canteens, homes, and other places where food is prepared for consumption.

A review of 212 investigated and published outbreaks of salmonellosis occurring mainly in the industrialized countries indicate that industrially produced foods account for less than 5% of outbreaks. Taking into consideration that the great majority of outbreaks resulting from preparation of food in homes or in small food service establishments is not investigated and published, it may be concluded with certainty that the number of outbreaks related to industrially produced foods is below 5%, perhaps less than 1% (WHO, 1998). A similar conclusion may be arrived at when examining the data of national surveillance programmes (WHO, 1995), stressing the importance of applying HACCP in small businesses and the need for training of food handlers and consumers. It should nevertheless be mentioned that if an error or negligence in the processing and manufacturing of food in large or medium-size food industries should occur, a large number of people may be exposed and affected, as demonstrated by a number of impressive foodborne disease outbreaks which have affected industrialized countries in recent years (Käferstein, Motarjemi & Beticher, 1997)

Many large and medium-size food industries realize the importance of food safety for their businesses. They have therefore voluntarily adopted the HACCP system in addition to complying with Good Manufacturing Practice. However, it is important that even small business including food service establishments recognize the importance of food safety and voluntarily introduce measures to prevent foodborne illnesses. In this regard, a major task for public health authorities is to promote food safety in the society and, in particular, among consumers so that these not only adopt safe food handling practices in their homes, but are also able to (a) recognize hazardous practices and foods, (b) demand hygienic practices, and (c) be appreciative of the efforts of those food businesses that practice it, even if their efforts may lead to justifiably higher prices.

It should not be overlooked that many raw foodstuffs that reach small food business, homes or consumers are already contaminated as a result of the food production system, especially due to problems at primary industry level, i.e. agriculture, animal husbandry and fishery. It remains a fact, however, that these problems are amplified because of lack of education and training in food safety, including in good hygienic practice and in the HACCP system, of those preparing food in small food businesses and in homes.

Fourthly, the HACCP system has still made little progress in countries where the burden of foodborne illnesses is the greatest, i.e. in the developing countries. In comparison with the industrialized countries, the problems of the developing countries with regard to food safety are far greater. The majority of foodborne illnesses occur in the developing countries, where bacterial, parasitical and viral diseases of varying nature as well as chemical intoxications affect millions of people on a daily basis. In these countries, except in the case of food exporting companies, the application of HACCP has made relatively little progress. The situation is of course not as pessimistic as a decade ago, when the level of awareness of the importance of food safety was very low or even non-existent. Today, there is indeed greater awareness, in part due to the efforts of the World Health Organization, but also due to the negative impact that foodborne disease epidemics and outbreaks have on trade and tourism. However, the battle is far from having been won. There is a long way to go from awareness to action. In many countries, a real commitment to food safety, backed by sufficient resources for development and implementation of food safety programmes, is still absent on the political scene. Considering the fact that many foodstuffs consumed in one country may be imported from another country, the food safety problems of one country can easily become those of another. In other words, the globalization of food supply also means globalization of the food safety problems. Subsequently, international cooperation in the prevention of food contamination and in assisting those that are in need of improving their food safety system and implementing the HACCP system is imperative.
4. Lessons learned from foodborne disease outbreaks

The potential of the HACCP system to prevent foodborne disease outbreaks lies in understanding it and applying it correctly. There are very few records of foodborne disease outbreaks where a food industry operating with full commitment and understanding of the HACCP system has been implicated in an outbreak. This demonstrates that when the HACCP system is applied correctly, positive results may be expected. In the few outbreaks that have been reported in the literature involving industries that have implemented the HACCP system, serious flaws could be detected in their HACCP plans or the implementation of HACCP, reflecting a lack of understanding of, or commitment to, the HACCP system.

In an outbreak of salmonellosis which occurred in the UK in 1996 and involved pasteurized cheddar cheese, the industry in question had an HACCP system in place, but no corrective measures were foreseen in the HACCP plan (Wall, 1998). Consequently, a failure in the pasteurization process had been monitored without any action having been taken to correct it. Weaknesses in the corrective action were also the source of another salmonellosis outbreak related to a baby cereal. In this outbreak, the industry in question identified Salmonella Senftenberg in the raw material and withdrew the contaminated raw material from production. However, the full consequence of the monitoring results, e.g. that other products of the supplier may possibly be cross-contaminated was not considered (Rushdy et al., 1998). The lessons learnt from these two outbreaks indicate the importance of introducing appropriate corrective measures and of taking into consideration the full implications of a situation when the monitoring results indicate loss of control at the critical control point. Another and third example of a salmonellosis outbreak involving an HACCP-operated industry in Denmark indicates lack of understanding of the HACCP system. The industry in question produced cured meat without the meat having undergone adequate heat treatment. Since the industry knew that the product was going to be eaten by consumers without subsequent heat treatment, it is clear that the HACCP plan of the industry could not have prevented such a foodborne disease outbreak since no control measure and critical control point was foreseen for Salmonella from the point of production to that of consumption (Eriksen, 1998).

These foodborne disease outbreaks demonstrate that the success of the HACCP system depends on the necessity to implement parallel but complementary measures during the entire food chain from production to consumption, including good hygienic practices during primary production, processing, transportation and distribution as well as preparation of food for consumption. Where a raw foodstuff is likely to be contaminated, as is the case of all foods of animal origin, it is imperative to consider introducing a killing step such as heat treatment or food irradiation. Where this is not the case, consumers should be strongly warned of the risk of eating the product raw or undercooked and should be made aware of the possibility of cross-contamination with other foods.

A number of other foodborne disease outbreaks demonstrated the need to implement the HACCP. One such case was an outbreak of listeriosis which occurred in France in 1993 involving 38 patients (31 maternal and 7 patients not associated with pregnancy). The outbreak was caused by rillettes (potted mince of pork) which had probably been cross-contaminated with raw meat, as a result of a shorter, thus less efficient, disinfection process of the production line and premises. The industry in question implemented the HACCP system after the outbreak which among other things led to a change in the flow-diagram of the process in order to minimize the risk of cross-contamination between the raw and the cooked products (Goulet, Rocourt & Rebière, 1998). The economic costs of this outbreak for the producers was enormous, as the whole rillettes production stopped for six months and the brand was discredited for a period of one month following the recall.

Another example of an outbreak which could easily have been prevented if an HACCP plan had been in place was an outbreak of E. coli O157 associated with pre-cooked meat patties affecting 32 school children. The investigation of the outbreak revealed that the meat patties had been undercooked. The speed of the conveyor belt and the flame height were adjusted manually by an operator so that the selection of higher belt speed or lower flame height might have led to inadequate cooking. There may also have been other contributory factors. However, again an HACCP plan including the establishment of critical limits at the cooking stage, e.g. limits for conveyor speed and flame height, and the monitoring of these parameters could have prevented the outbreak (Belongia & Mac Donald, 1991).

Finally, reference should be made to the major salmonellosis outbreak which occurred in USA in 1994 affecting an estimated 224,000 people. If the ice cream manufacturer or the premix suppliers had implemented comprehensive HACCP programmes comprising the transportation process too, the transportation of the product could have been recognized as a critical control point and the outbreak could have been prevented (Hennessy, 1996).

5. Misconceptions about the HACCP system

A number of controversies also arise from misconceptions about the HACCP system. If these miscon-
ceptions continue to persist, they will damage the reputation of HACCP and will jeopardize its benefits to society. It is important to clarify these misconceptions where HACCP is being introduced. Below are some of the misconceptions that have been experienced:

1. **HACCP is a new method that replaces previous methods of food safety assurance based on the application of good hygiene practices.** While it is true that the traditional methods have presented weaknesses and gaps in their approach to food safety assurance, the HACCP system does not replace them. The HACCP system is meant to complement the traditional methods by (a) identifying any additional or more specific control measures which the food or operation in question necessitates, (b) by placing additional emphasis on those points of good hygienic practices which are particularly important to the food or operation in question and which need to be closely monitored, (c) by foreseeing corrective measures in case monitoring results indicate loss of control, and (d) by giving more training and responsibility to operators.

2. **HACCP is an additional regulatory burden.** The HACCP system has been developed by the food industries and has been applied for years on a voluntary basis by these in view of the recognition of its benefits. HACCP has been promoted by the public health authorities because of its potential to prevent outbreaks of foodborne diseases. Considering the increasing number of people who are exposed to foodborne diseases as a result of industrialization, mass production and mass distribution, the requirements to apply the HACCP system in connection with commercially processed or manufactured foods by public health authorities was an unavoidable trend since the smallest error in food production could jeopardize the lives of many. The need to enhance food safety and increase the degree of food safety assurance has furthermore proved important since many foodborne pathogens which have emerged in our food supply present a serious risk to health or may be fatal.

   Unfortunately, in many countries, food businesses still do not recognize the need to improve food safety. This is partly due to the health system of the country (i.e. lack of recognition of the importance of combating foodborne illnesses and thus no incentive to strengthen the investigation and surveillance of these diseases). Lack of epidemiological information and proof of the involvement of food businesses in foodborne diseases make it difficult for the food control authorities to demonstrate the need for food businesses to improve the safety of their food.

3. **Application of the HACCP system is complicated and involves a substantial amount of documentation and record-keeping.** Any new system may at first seem complicated, particularly if the people concerned are not properly trained or if the right approach in the training of staff has not been adopted. In introducing the HACCP system to food businesses, it is important to demystify and simplify the concept and to explain the need and advantages of the system for the business itself. In the first stage, emphasis should be placed on the first five principles which make the real difference in terms of food safety. Food businesses should be made aware of the fact that the need for verification, record-keeping and documentation should be seen as a means for themselves to assure efficacy and adequacy of their own measures rather than providing proof to government officials that regulatory requirements have been met.

4. **Application of the HACCP system requires a large amount of resources.** Indeed, in the initial stages, the implementation of the HACCP system requires additional resources for the training of personnel, securing technical support, and possibly procuring additional equipment and material. However, in the long term, the invested resources will be rewarded by a decrease in recalling contaminated food, improved safety of the food, greater confidence of the customer, and lesser consumer complaints. In order to encourage food businesses to invest in the HACCP system, it is important for the public health authorities to educate consumers so that they in their turn also recognize and appreciate the efforts of food businesses who have invested in improving the hygienic quality of their food.

5. **HACCP does not work because it cannot ensure the safety of raw agricultural products.** As long as there is no control measure at the primary production level to prevent the occurrence of pathogens in the food or to eliminate them, the application of the HACCP system cannot ensure the safety of agricultural products, i.e. raw foodstuffs free of pathogens. It can, however, improve the hygienic quality by keeping the contamination at a lower level. On the other hand, an HACCP study of the entire food chain may demonstrate that a technology such as food irradiation or pasteurization is essential to ensure the safety of foodstuffs, particularly foods of animal origin. If no such technology is applied, consumers should be strongly discouraged from consuming these foods in their raw or under-cooked state, and be warned about the possibility for cross-contamination of other foods.

   On the other hand, where the process includes a killing step, e.g. heat treatment, the application of the HACCP system has been an effective means of ensuring safety of the products. An example, is the successful application of HACCP in the canning industry. Canned foods have a high record of safety.
and relatively rarely are they associated with foodborne disease outbreaks.

6. A regulatory approach to implementation of HACCP is essential for the prevention of foodborne illnesses. In many countries, in particular the developing countries, HACCP is presently applied in large food industries and for foods which are destined for export. It is certain that a regulatory approach to HACCP implementation will not only improve the safety of foods aimed for export, but will also ensure that sufficient attention is given to the safety of food intended for the local population. However, HACCP can be successfully implemented only when a food business realizes the need for the HACCP system, takes ownership of the system, fully understand the principles of the HACCP system, and when there is commitment on the part of both management and staff. A regulatory approach to the implementation of the HACCP system can do very little towards the fulfilment of these conditions. In other words, a regulatory approach will force food businesses to adopt the system, but whether this will lead to positive results or be successful in preventing foodborne disease outbreaks is questionable.

To implement HACCP only for the purpose of fulfilling regulatory requirements may do more harm than good to the HACCP system. Care needs to be taken (a) to demonstrate to the food businesses the need for the HACCP system, (b) to provide guidance and facilities for training, (c) to assist those businesses which have difficulties in implementing HACCP, and (d) to motivate them to adopt the system on a voluntary basis.

A regulatory approach can be effective only when the regulations are enforceable. It is thus essential that, before enacting regulations and making the HACCP system mandatory, the public health authorities should have a clear understanding and have formulated a policy as to how they plan to enforce the HACCP regulations. Failing this, confusion will prevail and jeopardize the successful implementation of HACCP.

The strength of the HACCP system in enhancing food safety lies in its maintenance, i.e. periodically revisiting the HACCP plan and assessing the adequacy of the HACCP plan, efficacy of its elements in achieving the set objectives, and in due course changing the plan. Such an assessment is particularly important when there has been a change in the food processing or manufacturing, e.g. change in equipment, employee practices, raw material, supplier, product formulation, processing procedure, storage, packaging, product specifications incl. intended use, etc. (Bernard, Stevenson & Gombas, 1998). However important this may be for the successful application of the HACCP system, the regulations and mechanisms for their enforcement cannot ensure that the food processors and manufacturers respect this aspect of the HACCP application.

7. Application of the HACCP system in small food businesses is not possible. It is a fact that small businesses, e.g. cottage industries, food service establishments, etc., have greater difficulty in applying the HACCP system. Some of these problems are due to lack of technical expertise (particularly with regard to hazard analysis and monitoring), greater inconvenience of record keeping and documentation, rapid turnover of staff, a larger variety of foods which are prepared. However, many of these problems also originate from the fact that managers and staff in many of these places have not received any or only inadequate training in food hygiene before a permit has been given to them to open a business. As a result, for them moving from no kind of food safety management system to a system where even the name seems complicated to pronounce is perceived as a giant step. The responsibility of public health authorities who have for years neglected the importance of food hygiene in small food businesses is enormous and today they have the huge task of giving advice to small businesses and assisting them in establishing a food safety management system. The task, though not impossible, should be introduced step-wise, starting with basic food hygiene. The application of the HACCP system at a later stage will be easier and more acceptable to these businesses.

6. Achievements of the HACCP system

The application of the HACCP system provides many advantages over traditional approaches, both in terms of a food safety assurance system in food industries and a tool for food inspection, and these have been described elsewhere (Motarjemi et al., 1996; WHO, 1997). It will still take some years before the impact of the HACCP system in protection of health can be demonstrated. However, the application of the HACCP system has already been fruitful.

The application of the HACCP system in the food industries, be it on a voluntary or mandatory basis, has facilitated the development of a science-based food safety programme. It has encouraged food industries to reflect in a conscientious and consequential way on the safety of their products. In food control, the HACCP system has strengthened the regulatory approach to food safety by providing food control authorities with an opportunity to revisit their method of food inspection and the training provided to food inspectors. The HACCP system has been a mechanism for shifting from the traditional method of food in-
spection from “floor and wall” examination to a more scientific approach based on a critical analysis of the food production system and identification and control of hazards on a continuous basis. It helps food inspectors to ask the right questions and at the right moment in the food production (i.e. step of food production).

The introduction of the HACCP system has given rise to a lot of debate in many countries. These debates have in themselves been beneficial to increased awareness and to bringing food safety to the forefront of priorities and discussions with regard to what food safety is, what level of risk is acceptable, which hazards should be considered, where they ought to be controlled, the types of technology needed, etc. The HACCP system has also brought together scientists of different disciplines to collaborate together and this will necessarily strengthen the capabilities of food safety authorities in combating foodborne diseases.

7. Conclusion

It is a fact that the HACCP system has the potential to prevent foodborne diseases, when it is applied from farm to fork. Where it is applied on a sound basis, it has without a doubt prevented many outbreaks by improving the hygienic quality of foods. However, as with any other preventive measure, it is difficult to demonstrate its effect since it would imply demonstrating all outbreaks which could have occurred but did not take place.

The paradox between the increase in foodborne diseases and the implementation of the HACCP system originates from a misunderstanding of what HACCP is, its role in public health, and what can be achieved by its application.

Certainly, the HACCP system is not the panacea of all food safety problems. It is a tool which guides the food safety assurance personnel to consider all safety aspects and ensure that what needs to be done is done. Its successful implementation requires an understanding of its principles and a commitment to its implementation, i.e. the principles are scrupulously applied. The HACCP system per se does not make food safe, but it is its “correct application” that can make a difference.

Neither is the HACCP system the magic wand which can turn unsafe food into safe food. The HACCP system should not be a tool for politicians to gain the confidence of consumers. The HACCP system has power, but also certain limitations.

The factors influencing the occurrence of foodborne diseases are diverse and complex. To combat foodborne illnesses, public health authorities have to resort to an array of interventions, the application of the HACCP system in food businesses being only one of these. Equally important is the observation of good hygiene practices throughout the whole food chain (including primary industry, food processing and manufacturing, transport and distribution and preparation for consumption), the application of technologies with the potential to render raw foodstuffs safe, training and education of consumers in safe food handling, investigation and surveillance of foodborne diseases and monitoring contaminants in order to ensure that resources are invested in the right order of priority.

Acknowledgements

The authors would like to acknowledge with thanks the contributions of Dr. Mike van Schothorst in reviewing the article, Ms Akosua Asante in providing data on foodborne disease outbreaks, and Mrs Annette Enevoldsen for her support in preparing this article.

References


